A NOVEL ALGORITHM FOR CLEANICAL ROUTINE USING SYSTEM INTEGRATION OF PACS AND CBIR

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ABSTRACT

In medical organizations various softwares are being used and there is a need of common standard for providing communication between them. HL7 standard can be used to exchange data between different applications running at different platforms. It also provide independent processing of data. This paper aims to produce a system which works on DICOM images. DICOM images will be given as input to the system, then it will retrieve similar images and provide readable medical data.

KEYWORDS: System Integration, PACS and CBIR, DICOM Images

INTRODUCTION

Health Level 7 (HL7) as an organization that creates health care messaging standards. Health Level 7 is also developing standards for the representation of clinical documents. These document standards make up the HL7 Clinical Document Architecture (CDA).

HL7 Standard

HL7 is a standard and framework which is acceptable worldwide for its capabilities like exchange, integration, sharing and retrieval of electronic health information constitute HL7 standards.

It is based on the data which is obtained from medical and clinical sites which is approved by ANSI. The aim of HL7 Standard is to provide interoperability that improve patient care , reduce ambiguity, optimize workflow and it will also enhance knowledge among various stake holders, healthcare providers and various government agencies.

Why Named HL7?

Every message format of HL7 finds its place on the seventh level of OSI protocol of ISO. Interoperability being its main concern, it has its name highlighted in bolds for improving patient care, reducing ambiguity and adding a great deal to the knowledge of healthcare providers. Thus it forms a part and parcel for packaging and communicating information from one system to another.

How is HL7 Organized?

(a)Components (b) Delimiter Characters (c) HL7 message Type (d) Organization of HL7 segments.

- **Components:** Each HL7 message has one or more segments and each segment further is constituted by one or more composites or fields.

- **Delimiter Character:** They help in keeping one composite apart from the other present in single system.

- **HL7 Message Type:** The message type brought in common practice are as follows:

    - **ACK** – General Acknowledgement

    - **ADT** - Admit Discharge Transfer

    - **MFN** - Master files notification

    - **MDM** – Medical document management

    - **BAR** – Add/change billing account

Organization of Segments

A message consists of segments which are separated by the segment terminator. Each segment consists of fields separated by the field separator. Each field is composed of one or more components separated by the component separator and each component corresponds to a specific data type. Depending on its data type, a component may contain one or more subcomponents which is further separated by the subcomponent separator.

PACS

Picture Archiving and Communication system is an integrated computer system that provide storage and retrieval of digital images and eliminates the need to manually store, retrieve or transfer those images. PACS is mainly used in large number of hospitals in their radiology department. In medical arena PACS handle different images from different modalities like CT, MRI, tomography, X-Ray etc. Its main purpose is to replace hard film copies with digital images that can be used and seen by several different medical professionals and different medical automation systems simultaneously. The standard format for PACS is DICOM, accepting any image that is in DICOM format. Before PACS, there was no standardized image format due to which image retrieval and matching was difficult task and vendors could not share information among others to enhance their knowledge and for better diagnosis.

CONTENT BASED IMAGE RETRIEVAL (CBIR)

Color, Texture and shape forms the basis for retrieving images in CBIR. Thus the monitoring of sorting out images in an extensive database is ruled out. Whereby the content of image is analyzed , which promises better and accurate results. Indexing of images and retrieving them forms the main concern of CBIR. Image retrieval algorithm comes under two categories:

- **Text Based:** The text-based approaches associate keywords with each stored image in the database which are typically generated manually. Annotating images manually is a cumbersome and expensive task for large image databases, context-sensitive, subjective and incomplete. Image retrieval based only on text information is not sufficient, since it cannot capture the visual content such as color, texture or shape etc and can sometime produce ambiguous or unwanted data, which lead to inaccuracies during the retrieval process. Hence there is need for a better system. To overcome problems with text-based approach resulted in use of some better and efficient way of image search that is content based medical image retrieval.

- **Content Based:** The main goal in CBIR system is searching and finding similar images based on their content, some silent features of image are picked, thereby index and similarity is drawn. They make use of techniques,

tools and algorithms that are originated from fields of statistics, pattern recognition, signal processing, and computer vision. When the query image is passed to the system, the system extracts image features for the query and compare those features with that of other images in a database. On the basis of search, required results are produced to the user. Thus making the fast and accurate retrievals possible.

HL7 CDA

HL7 popular for creating health care messaging standards also has huge contribution in representing clinical document , it got ANSI approval in November 2008.It is a standard for giving specification regarding structure and semantics of clinical documents. It addresses common and large narrative clinical notes. Being a part of HL7 version 3 family it gets its semantic content from HL7 reference Information Model. CDA is derived from the HL7 Reference Information Model (RIM) and user-controlled terminology such as SNOMED CT, LOINC, CPT, ICD, and R x Norm

Methodology

The development of PACS (Picture Archiving and Communication Systems): PACS network is constructed which consists of a central PACS server that provides storage for database containing the images. The images from various modalities (CT, MRI, Ultrasounds etc) are stored in DICOM format and multiple clients have access to those centrally stored images. They can retrieve and display these images on medical imaging software named as DICOM viewer or these images are converted into other image formats like Jpeg, png eliminating the need of using an additional software i.e DICOM viewer.

To interface two different formats HL7 and DICOM, HL7 CDA is used, which is organized into three levels. It focuses on content of clinical documents, which are persistent and human readable. CDA is XML based standard and make use of this markup language for providing clinical documents.HL7 CDA does not define how EHR's communicate with each other, for this CDA documents are transmitted to HL7 message designed for transfer of clinical document.

Implementation STEPS

A welcome screen appears on running the project which gives the option of selecting a DICOM category, DICOM detail and Search DICOM.
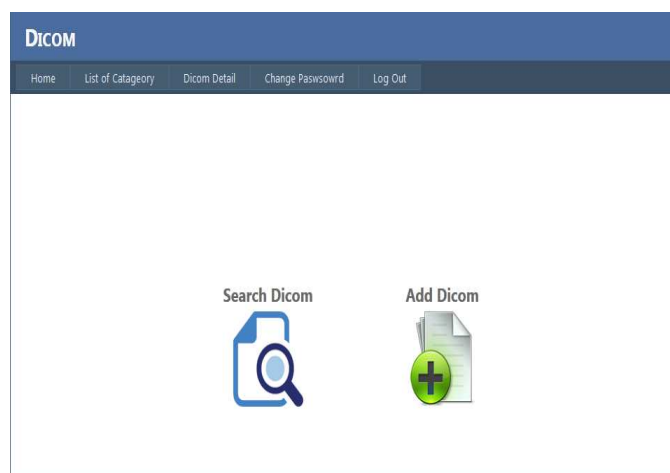

Figure 1

Category details that gives the options of adding and deleting and editing the DICOM. Here the different images are categorized on the basis different modalities CT scan, MRI, ultrasound etc.
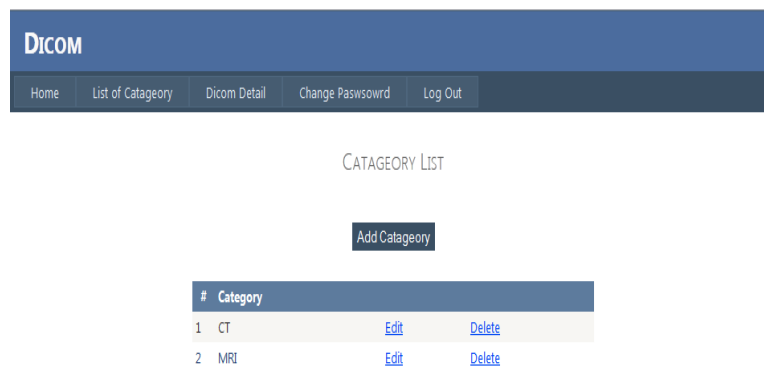

Figure 2

Various categories of DICOM and the option of directly VIEW detail which is for directly viewing DICOM details along with download image, download text file and download CDA file which is the final output of this study.
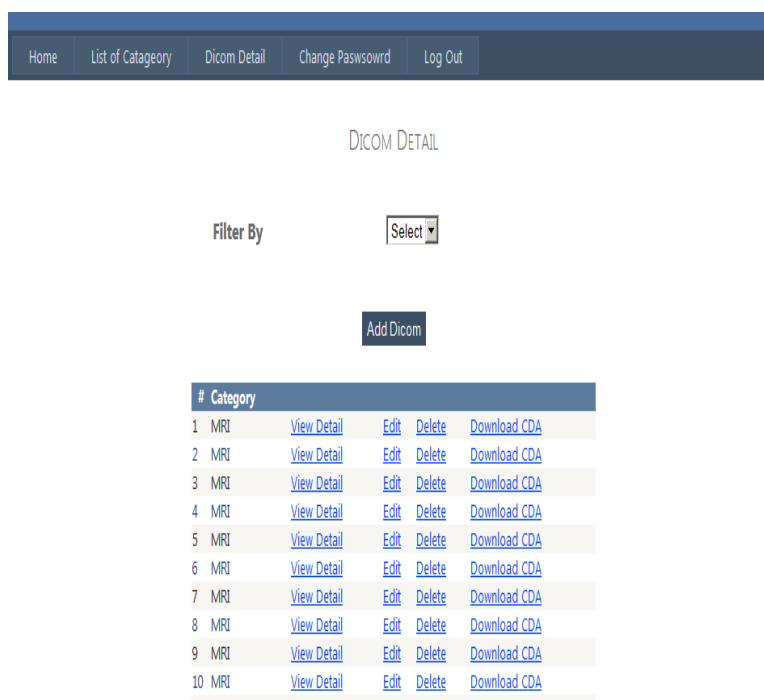

Figure 3

The record of the DICOM DETAIL file which comprises of various tag values (0002 0003, 0010, 0012, 0013 0005 etc) and corresponding Class UID (implementation version name, image type, instance creation date) is obtained and displayed on the graphical user interface panel.
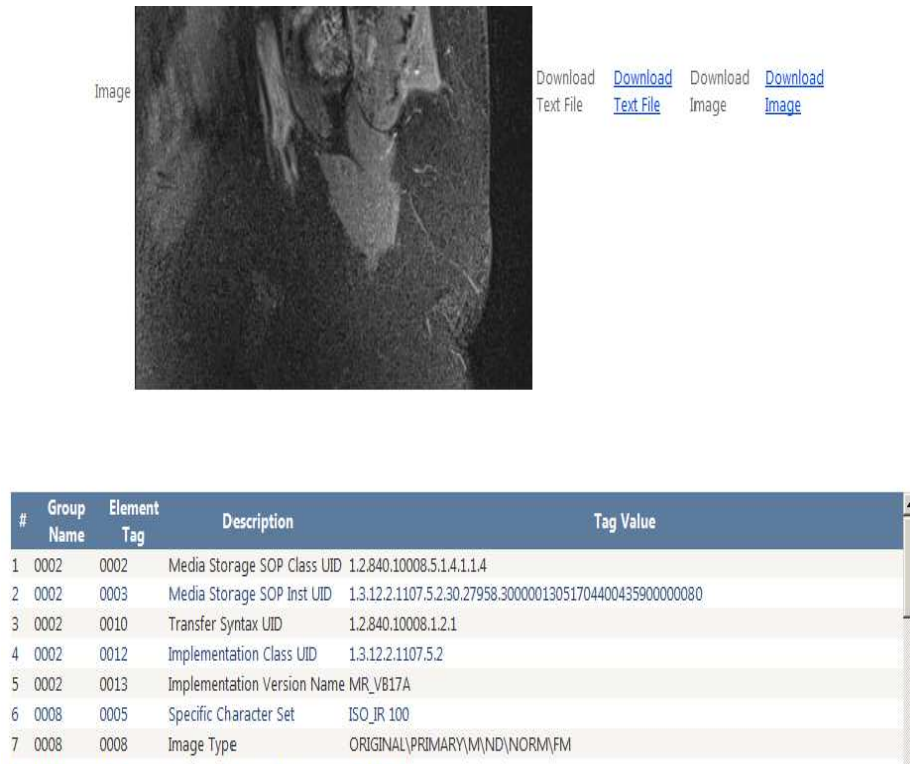
Figure 4

DICOM Text File describes various fields like study date, modality, institution name and address, operators name, physicians name and much more information which ease in studying the case.
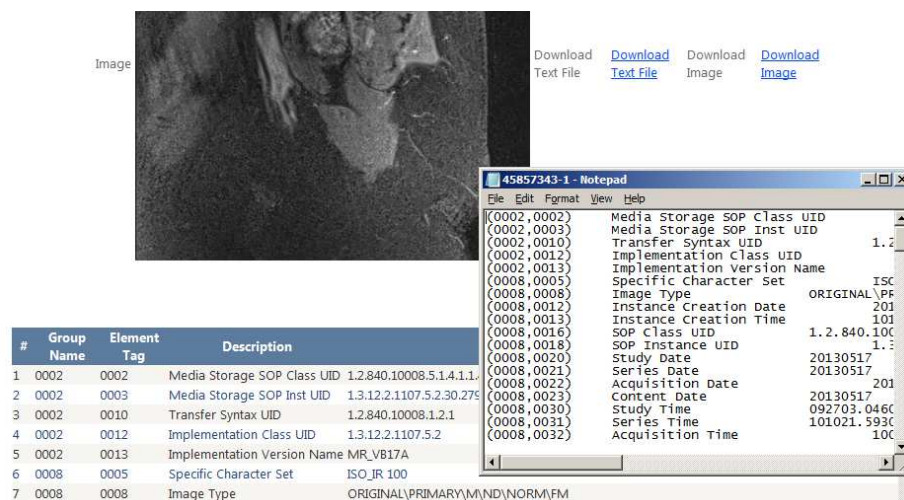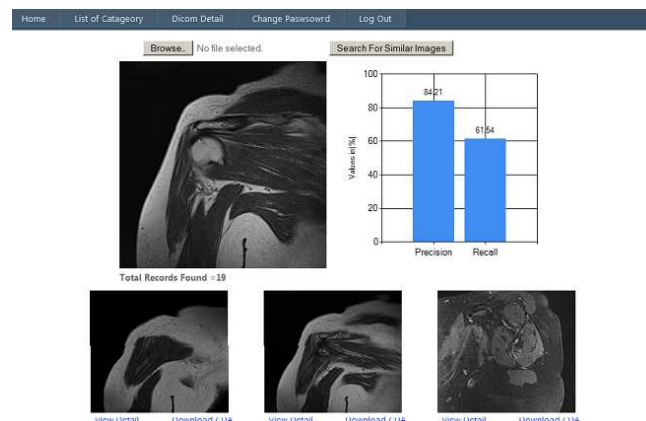

Figure 5

RESULTS

Figure 6

CONCLUSIONS

To facilitate the national interoperability of healthcare IT systems, it has become important to consider the adoption and consistent use of standards. It brings need of adopting a national data content standard for use within all healthcare systems.

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